

The Wind and Temperature Spectrometer (WTS) in the Atmospheric Neutral Density
Experiment (ANDE) Satellite

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Miniaturization efforts in new spectrometers for ionosphere/thermosphere investigations of the ion-drifts and neutral winds and corresponding temperatures make possible very light (about 250 g) packages consuming less than 0.4 W. Previously described, our approach measures the angular and energy distributions of neutral atoms and molecules (or ions) in two perpendicular planes; using those distributions to determine the full wind vector, the temperature and the relative densities of O and N₂, as required for the ANDE mission. The measurements require two separate electron impact ion sources each with its own electron beam cathode. We have developed a low-temperature thermionic emission cathode that delivers 1 mA electron current at 80 mW power, making it possible to operate neutral wind/temperature experiments for the first time with powers less than 0.5 W. Advances in the ion optics of the energy-angle spectrometer enhance the energy resolution-aperture product more than a factor of 3 to enable energy resolutions of a few percent with large apertures. With these technology improvements it is now possible to obtain the full neutral wind vector, temperature and O/N₂ density ratio once per second in a 250g/0.4W package with sensitivity up to about 500 km altitude in the thermosphere. We will describe the WTS as deployed in ANDE and show simulated data with the non-linear least squares analysis to illustrate expected performance of the WTS in the estimated errors in the three components of the wind, the temperature, and the relative densities.